

Spherical shape of the Earth and drops of mercury.

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The answer to the question why the earth is spherical is inherently chemical, and will eventually turn out to be mathematical - if the true cause of the phenomenon is considered and fully understood.

To understand that gravity is insignificant for this phenomenon (it only plays a certain role for planets and other astronomical objects), consider a liquid in zero gravity - the force of gravity can be excluded, but liquid droplets form ideal spheres of various radii. Or, for example, raindrops - they are of course curved by the Earth's gravity, but initially they also form spheres. Or, consider droplets of mercury on the floor - these are also almost ideal spheres (the larger the drop, the greater the curvature).

Therefore, let's change the question posed to a more general question: why does a liquid or other similarly bound particles, in the absence of external forces, always take the form of an ideal sphere?

To answer, consider a conventional beaker with distilled water. Now notice that all water molecules can be divided into two types:

1. Surface molecules - water molecules placed on the surface of a liquid.
2. "Internal molecules" of water - molecules surrounded by other molecules on all sides (bottom, top, side, etc.). That is, the molecules are "inside" the liquid.

These two types of molecules differ dramatically - surface molecules have more energy than all other molecules. Since, molecules surrounded on all sides by other molecules, by definition, have a smaller supply of potential energy.

"Internal molecules", or any internal particles, interact with all surrounding molecules/particles, and as a result of the interaction, a certain amount of energy is released.

It is clear that since surface molecules/particles interact with fewer particles, less energy is released. Therefore, surface molecules/particles will always have an increased potential energy (compared to "internal molecules/particles").

Of course, this applies to all liquids and, in general, to all bodies of any state of aggregation, since it is based on the concept of potential energy. Moreover, this is valid for all types of interaction between particles. In support of what has been said, let us recall burning in weightlessness, the flame of a candle takes on a spherical shape, and the gas mixture burning in weightlessness forms an ideal sphere.

Let's well remember a simple statement: molecules, atoms or other particles of the surface layer always have an increased potential energy than any "internal particle" of a liquid or body (any state of aggregation).

Further, we recall that any physical system tends to a minimum of energy. However, the systems under consideration contain surface particles that have an increased potential energy reserve. Consequently, the system will have a minimum energy when there is a minimum of surface particles.

And this means that a certain mass (for example, liquids) must take such a shape that the surface area is minimal.

Mathematics unequivocally states that a ball has a minimum surface area, and all other bodies of a given mass will have an area larger (cube, cylinder, parallelepiped, etc.).

Thus, all liquid bodies in the absence of external forces, or when external forces are insignificant, take the form of an ideal sphere - water in weightlessness, mercury on the floor, etc.

It is interesting to note that if the cohesive forces of the particles of the liquid and the contacting surface are slightly greater than the cohesive forces inside the liquid itself, then the liquid will wet this surface and spread like ordinary water on the floor.

If the adhesion forces inside the liquid are greater than the adhesion forces between the particles of the liquid and the surface, then the surface will not be wetted, and as a result, almost ideal spheres consisting of liquid will roll along the floor (for example, mercury on the floor, or ordinary water on a hydrophobic surfaces). The contact angle in both cases will depend only on the ratio of cohesive forces.

Now back to planet Earth. All planets and stars of all types, for the reason described above, will have a spherical shape. Since strong gravity destroys any shape of the body (if the original solid body had a shape), and to minimize the potential energy, the astronomical object takes the form of a sphere. It is clear that ideal sphericity can be distorted under the influence of various reasons. If the gravity is less than that of the planet, for example, that of asteroids, then the shape of the body will be preserved.

With a further increase in gravity (from planets to stars), chemical bonds and atoms are destroyed and the usual evolution of matter takes place, which is studied by astronomy.

I will especially note that the minimum of potential energy during the formation of a planet or star is not identical to the minimum of gravitational potential energy. Since the interaction between neighboring particles in stars and planets, although due to gravitational contraction, is essentially non-gravitational in nature (gravity between neighboring particles is negligible). In fact, it should be so, because the gravitational field, according to the theory of relativity (GR), is not a physical field in the usual sense, like an electromagnetic field, but is a curved space-time.

A minimum of gravitational potential energy is possible only for the ideal case – “gravitational fluid”, when there is only gravitational interaction between particles, and all other interactions are absent.